WHAT IS CLAIMED IS:

Rule 1.126

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1. A system for analyzing radiation from an extended source having at least two spatial components that emit or scatter radiation, comprising:

first optics collecting and focusing radiation from said extended source to form at least two images along an encoding axis onto an encoding plane, said images corresponding to said spatial components;

a two dimensional spatial radiation modulator rotated about a rotation axis and positioned in said encoding plane so that said encoding axis is along a radial axis, said modulator having radiation filters at different radii from said rotation axis, said filters modulating the intensity of a corresponding spatial components to provide an encoded beam comprising at least one encoded component as said modulator is rotated about said rotation axis;

a detector;

second optics for collecting and directing said encoded beam onto said detector, causing the detector to provide an output; and

computer analyzing signals generated by said detector in response to said encoded beam.

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2. The system of claim 1, wherein said extended source is an assembly of different samples.

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3. A method for analyzing radiation from an extended source having at least two spatial components that emit or scatter radiation, comprising:

providing radiation from an extended source having at least two spatial components that emit or scatter radiation;

collecting and focusing radiation from said extended source to form at least two images along an encoding axis onto an encoding plane, said images corresponding to said spatial components;

positioning a two dimensional spatial radiation modulator in said encoding plane and rotating said modulator about a rotation axis so that said encoding axis is along a radial axis, said modulator having radiation filters at different radii from said rotation axis, said filters modulating the intensity of a corresponding spatial components to provide an encoded beam comprising at least one encoded component as said modulator is rotated about said rotation axis;

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collecting and directing said encoded beam onto said detector; and

analyzing signals generated by said detector in response to said encoded beam.

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4. The method of claim 3, wherein said extended source is an assembly of different samples.

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8. A radiation spectrum analyzer comprising:

at least one source providing a plurality of radiation components;

first optics collecting radiation from said source and forming an image onto an encoding plane, said image comprising at least two radiation components substantially separated from one another along an encoding axis;

a two dimensional spatial radiation modulator rotated about a rotation axis and positioned in said encoding plane so that said encoding axis is substantially along a radial axis, said modulator having at least one radiation filter pair to provide an encoded beam as said modulator is rotated about said rotation axis, said pair comprising two radiation filters located at different radii from said rotation axis for modulating the intensity of corresponding radiation components, said filters having modulation functions that are complementary to each other to provide a single encoded component, said encoded component having an amplitude and phase which is determined by the relative intensity of said corresponding radiation components;

a detector;

second optics collecting and directing said encoded beam onto said detector, causing the detector to provide an output; and

computer analyzing signals generated by said detector in response to said encoded beam.

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6. The analyzer of claim 5, wherein the respective widths of said filters of said pair are engineered to substantially null the amplitude of said encoded component.

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7. The analyzer of claim 5, wherein said filters of said pair are substantially adjacent to one another.

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8. The analyzer of claim 5, wherein said first optics includes at least one refractive or diffractive element and said radiation components correspond to substantially distinct spectral components of said source.

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9. The analyzer of claim 5, wherein said source is an extended source and said radiation components correspond to substantially distinct spatial components of said extended source.

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10. A method for analyzing a radiation spectrum, comprising:

providing at least one source providing radiation;

collecting said radiation and forming an image onto an encoding plane, said image comprising at least two radiation components substantially separated from one another along an encoding axis;

positioning a two dimensional spatial radiation modulator in said encoding plane and rotating said modulator about a rotation axis so that said encoding axis is substantially along a radial axis, said modulator having at least one radiation filter pair to provide an encoded beam, said pair comprising two radiation filters located at different radii from said rotation axis for modulating the intensity of corresponding radiation components, said filters having modulation functions that are complementary to each other to provide a single encoded component, said encoded component having an amplitude and phase which is determined by the relative intensity of said corresponding radiation components as said modulator is rotated about said rotation axis;

collecting and directing said encoded beam onto a detector; and

analyzing signals generated by said detector in response to said encoded beam.

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11. The method of claim 10, wherein said filters of said pair are substantially adjacent to one another, and said analyzing includes calculating the derivative of the image intensity with respect to position along said encoding axis evaluated at the border between said adjacent radiation filters.

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12. The method of claim 10, wherein said forming includes refracting or diffracting said radiation, and said components correspond to substantially distinct spectral components of said source.

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114
~~13~~. The method of claim 10, wherein said source is an extended source and said radiation components correspond to substantially distinct spatial components of said extended source.

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~~14~~. A method for analyzing radiation, comprising:

providing a radiation beam comprising at least one selected radiation component;

collecting said radiation beam and focusing each said radiation component at a corresponding point along an encoding axis onto an encoding plane;

positioning a two dimensional spatial radiation modulator in said encoding plane and rotating the modulator about a rotation axis so that said encoding axis is substantially along a radial axis, said modulator having at least one radiation filter at a radius from said rotation axis, said filter modulating the intensity of a corresponding radiation component to provide an encoded beam comprising at least one encoded component;

collecting and directing said encoded beam onto a detector so that said detector provides an output; and

analyzing signals generated by said detector, said analyzing including subtracting the detector output from an expected detector output as a function of the rotation angle of said modulator about said rotation axis to provide an output difference function, said analyzing further comprising analyzing said output difference function to detect sub-rotational period transients in the amplitude of one or more encoded components.

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~~15~~. The method of claim 14, further comprising adjusting the speed of said rotation in response to said output difference function.

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~~16~~. A method for analyzing radiation, comprising:

providing a first radiation beam comprising at least one selected radiation component;

collecting said first beam and focusing each said radiation component at a corresponding point along an encoding axis onto an encoding plane;

positioning a two dimensional spatial radiation modulator in said encoding plane and rotating the modulator about a rotation axis so that said encoding axis is substantially along a radial axis, said modulator comprising a pattern on a rotating substrate, said pattern having at least one radiation filter at a radius from said rotation axis, said filter modulating the intensity of a corresponding component to provide an encoded beam comprising at least one encoded component, said pattern further comprising at least one

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series of marks, said marks having optical characteristics substantially different from said substrate, said series of marks being substantially confined to an annular region of said modulator with respect to said rotation axis;

collecting and directing said encoded beam onto a detector so that the detector provides a data signal in response to said encoded beam;

analyzing said data signals, said analyzing including determining the modulated amplitude of at least one encoded component;

positioning a second radiation source and second detector so that said marks modulate beam from said light source to said second detector to generate an alignment signal;

analyzing said alignment signal to detect wobble of said modulator and alignment errors of said pattern on said modulator;

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17. The method of claim 16, further comprising dynamically positioning one or more optical elements in response to said alignment signal to minimize the undesired effects of said wobble and said alignment errors.

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18. A system for monitoring radiation from at least one radiation source, comprising:

a beam comprising at least one radiation component, said radiation component corresponding to a distinct radiation source having an intensity and a center wavelength;

first optics collecting and dispersing said beam and focusing each said radiation component to form a corresponding image along an encoding axis onto an encoding plane;

a two dimensional spatial radiation modulator rotated about a rotation axis and positioned in said encoding plane so that said encoding axis is substantially along a radial axis such that a change in the center wavelength of said radiation component will cause said corresponding image to move substantially along said radial axis, said modulator having at least one radiation filter pair for modulating the intensity of a corresponding radiation component to provide an encoded beam comprising at least one encoded component, said pair comprising two radiation filters located at different radii from said rotation axis and having modulation functions that are complementary to each other such that the amplitude and phase of said encoded component is determined by the relative proportion of radiation incident on the two filters;

second optics collecting and directing said encoded beam onto a detector; and

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computer analyzing signals generated by said detector in response to said encoded beam.

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~~19~~. The system of claim 18, further comprising at least one control signal for adjusting said center wavelength of at least one source in response to the signals generated by the detector to tune said sources.

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~~20~~. The system of claim 18, wherein said radiation filters comprising said pair are substantially adjacent to one another.

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~~21~~. The system of claim 20, wherein the border between said adjacent radiation filters is substantially located at the radius which correspond to the nominal or desired center wavelengths for said radiation source.

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~~22~~. A method for monitoring radiation from at least one source, comprising:

providing a beam comprising at least one radiation component, each said radiation component corresponding to a distinct radiation source and having an intensity and a center wavelength;

optics collecting and dispersing said beam and focusing each said radiation component to for a corresponding image along an encoding axis onto an encoding plane;

positioning a two dimensional spatial radiation modulator in said encoding plane and rotating the modulator about a rotation axis so that said encoding axis is substantially along a radial axis such that a change in the center wavelength of said radiation component will cause said corresponding image to move substantially along said radial axis, said modulator having at least one radiation filter pair for modulating incident radiation to provide an encoded beam comprising at least one encoded component, said pair comprising two radiation filters located at different radii from said rotation axis and having modulation functions that are complementary to each other such that the amplitude and phase of said encoded component are determined by the relative proportion of radiation from the beam incident on the two filters;

collecting and directing said encoded beam onto a detector; and

analyzing signals generated by said detector in response to said encoded beam.

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129 ~~23~~. The method of claim 22, further comprising adjusting said center wavelength of at least one of said sources in response to signals generated by said detector.

125 ~~24~~. The method of claim 22, wherein said radiation filters comprising said pair are substantially adjacent to one another.

126 ~~25~~. The method of claim 24, wherein the border between said adjacent radiation filters is substantially located at the radius which correspond to the nominal or desired center wavelengths for said radiation source.

127 ~~26~~. A radiation analyzer for analyzing a sample, comprising:

one or more excitation sources providing excitation radiation, said excitation radiation comprising two or more distinct excitation components;

first optics directing said excitation components to the sample substantially in sequence;

second optics collecting a response beam of radiation from said sample, said response beam comprising at least one radiation response components emitted, transmitted or scattered by the sample in response to said excitation radiation, and focusing each said response components at a corresponding point along an encoding axis onto an encoding plane;

a two dimensional spatial radiation modulator rotated about a rotation axis and positioned in said encoding plane so that said encoding axis is substantially along a radial axis, said modulator having at least one radiation filter at a radius from said rotation axis, said filter modulating the intensity of a corresponding response component to provide an encoded response beam comprising at least one encoded response component;

a detector;

third optics collecting and directing said encoded response beam onto said detector, causing the detector to provide an output; and

computer analyzing signals generated by said detector in response to said encoded response beam.

128 ~~27~~. A method for analyzing a sample, comprising:

providing one or more excitation sources to provide excitation radiation, said excitation radiation comprising two or more distinct excitation components;

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directing said excitation components to the sample substantially in sequence;

collecting a response beam of radiation from said sample, said response beam comprising at least two radiation response components emitted, transmitted or scattered by the sample in response to said excitation radiation, and focusing each said response components at a corresponding point along an encoding axis onto an encoding plane;

positioning a two dimensional spatial radiation modulator in said encoding plane and rotating said modulator about a rotation axis so that said encoding axis is substantially along a radial axis, said modulator having at least one radiation filter at a radius from said rotation axis, said filter modulating the intensity of a corresponding response component to provide an encoded response beam comprising at least one encoded response component;

collecting and directing said encoded response beam onto said detector; and

analyzing time-based signals generated by said detector in response to said encoded response beam.

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~~28~~. The method of claim 27, wherein said analyzing separates said time-based signal into sub-signals, wherein each said sub-signal corresponding to the encoded response components corresponding to only one of said excitation components, and analyzes said sub-signals to determine the amplitude of at least one encoded response component as a function of said corresponding excitation component.

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~~29~~. A two dimensional spatial radiation modulator adapted to be rotated about a rotation axis to modulate at least two components of an incident radiation beam to encode said beam as said substrate is rotated about said rotation axis, said modulator comprising a substrate and at least one radiation filter pair, said pair comprising two radiation filters located at different radii from said rotation axis for modulating the intensity of corresponding radiation components, said filters having modulation functions that are complementary to each other to provide a single encoded component, said encoded component having an amplitude and phase which is determined by the relative intensity of said corresponding radiation components.

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~~30~~. The modulator of claim 29, wherein said filters of said pair are substantially adjacent to one another.

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